Australian Geoscience Council Inc.

The Council of Earth Science Societies in Australia

AGC

Australian Geoscience Council Submission to the "Review of the impact of the Higher Education Support Act 2003."

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Introduction

The Australian Geoscience Council (AGC) is the Peak Council of geoscientists in Australia. It represents nine major geoscientific societies[1] with a total geoscience membership of ~9000 comprising industry, government and academic professionals in the fields of geology, geophysics, geochemistry, mineral and petroleum exploration, hydrogeology and geological hazards. The geosciences are critical for Australia, because they are fundamental to the development of Australia's resource endowment including ground water and increasingly make a major contribution to the management of the natural environment and man's impact on that environment. They also contribute to the broader community understanding of the land of Australia and in understanding how it must be managed to sustain our prosperity and environmental well-being. The geosciences are a key underpinning of the current resources boom in Australia's economy and the consistent 40% share of Australia's export earnings derived from the natural resources sector.

In recent years, there has been increasing concern within the geoscience community about the health of geoscience education in Australia and the demise of some earth science educational opportunities, university earth science teaching departments and staffing levels[2] [3]. The concern is the ability of the higher educational system to provide the appropriately trained geoscientists required by the economy and Australian society, and general education of Australian society about the discipline of geoscience into the future. In the next few years this situation will rapidly reach a crisis point.

Despite these concerns and efforts at strengthening some earth science educational capabilities and sponsoring of some courses in some departments particularly as it relates to the minerals industry by the Minerals Tertiary Education Council (MTEC)[4] and some employers (e.g. Geoscience Australia)[5], the problem continues and is growing[6] [7] [8] [9]. There is anecdotal evidence that some employers are refusing to take graduates from some universities where the degree in geoscience is not seen as being of an appropriate standard. Honours and sometimes MSc degrees are required levels of academic achievement for many employers of geoscientists.

The Current Situation in Tertiary Geoscience Education

The current state of play has been succinctly put as follows[8].

"In 1990, 28 departments offered earth sciences around the country and it was a small, but mainstream science. By the end of the this year (2006) there will be five of the

[1] The Australian Geoscience Council comprises the Presidents of CEO's of the following professional and learned societies: Association of Applied Geochemists, Australasian Institute of Mining and Metallurgy; Australian Geoscience Information Association; Australian Institute of Geoscientists, Australasian Quaternary Association, Australian Society of Exploration Geophysicists, Geological Society of Australia, International Association of Hydrologists (Australian Chapter), Petroleum Exploration Society of Australia.

[2] Mineral Council of Australia, Back from the Brink: Reshaping Minerals Tertiary Education, MCA National Tertiary education Taskforce, MCA, Canberra 1998.

[3] National Committee for Earth Sciences, National Strategic Plan for the Geosciences, Australian Academy of Science , Canberra 2003.

[4] www.minerals.org.au/education

[5] www.ga.gov.au/jobs/#cadet

[6] Australian Institute of Mining and Metallurgy, Pre - budget Submission 2007.

[7] Cas, R. Geosciences – An endangered species, 18th AGC – Australian Earth Sciences Convention, 2006

[8] Hall, M & Hill, K. Time to Invest in Earth Sciences. PESA News Oct/Nov 2006, Petroleum Exploration Society of Australia Ltd, p 118-119.

[9] Webb, G.E. Some thoughts on Australian universities and the petroleum industry in 2006. PESA News Aug/Sept 2006, Petroleum Exploration Society of Australia Ltd, p38-39.

original geoscience/earth science departments left in Australia and it is a niche science albeit vital to the nation The other departments have either closed or been forced into unions with biology, geography, physics, maths, or environmental science. This decade the number of honours graduates and students currently enrolled in Honours courses has more than halved"

(Note the numbers are around 260 graduates in the year 2000 to just over 100 graduates in the year 2005 of which close to 90 percent are in departments which have received support form MTEC – indeed as the authors note these departments have generally sustained their student levels through this period. There has been a decline in teaching capacity[3)].

In the period 1990 to 2003 there was a decline in tenured teaching staff of 34 percent. Against international benchmarks geoscience-teaching departments are understaffed. The Australian Geoscience Council Working Party expressed this concern in 1992 and the situation has since deteriorated. A recent comparison (in 2003) *was undertaken by one of the largest Australian geoscience departments with two overseas departments, one in the United States and one in the United Kingdom, that were broadly similar in terms of student numbers. The comparison revealed that the two overseas departments had 2.5 and 2.9 times the number of academic teaching staff compared with the Australian department, ……..*

The explanation, which seems to have general consensus, has been stated by Webb[9]
"The current university funding model provides funds on a per-student basis, with the salaries of staff (academic, support and administrative) infrastructure and expendables (including field teaching) being paid from those funds. However with low student numbers such funds are inadequate to pay for the necessary infrastructure to support study in expensive and technologically sophisticated fields like geology, geophysics and petroleum engineering. …… Thus the fundamental problem: teaching areas that by their nature have low student numbers (such as geology) provide little money for the university. Thus with low student numbers, expensive science and engineering programs are not economically viable, and are thus vulnerable to closure

Universities themselves are under no obligation to maintain teaching or research areas that are strategically critical to Australia's economy. Instead through economic rationalization they have been forced to depend upon market forces that are dominated by student choices for their primary funding. Popular, well attended courses that are perceived as easy options by students (e.g arts and business) are well-funded and help the university's bottom lines, whereas expensive-to–teach, poorly attended courses (such as geoscience and engineering) are considered detriments to university finances."

As a result, earth science departments have closed or been amalgamated with other science departments and staffing reduced to the point where their capacity to deliver a serious undergraduate major in geoscience has been severely compromised.

The issue therefore becomes a balance of:

- demand by students for geoscience places at university
  - an issue of interest in geoscience and job opportunities for graduates

- capacity at universities to deliver a quality undergraduate degree.
  - an issue of critical mass and appropriate levels of funding.

The seriousness of this situation has prompted the AGC member societies and the related industry bodies to undertake a number of actions to contribute to solutions and these are briefly summarized in the Appendix which addresses the first of these points. However these actions in themselves are insufficient for a sustainable tertiary geoscience education where it is the funding mechanism that influences university behaviour in maintaining teaching capacity in disciplines where demand for graduates is important, but not necessarily in large numbers.

The AGC believes the Government must adopt a national strategic approach to ensure that Tertiary Teaching Capacity is maintained in important minority disciplines such as geoscience. There is no other organisation which is in a position to ensure that the national interest is maintained in the provision of Tertiary education in these minority disciplines. The AGC is concerned that there appears to be little understanding at the national level of the way the funding mechanism interacts with the dynamics of university funding to produce outcomes that are not in the national interest. As the discussion paper states, *"providers may adopt their own internal resource allocation methods to allocated CGS funds to particular courses. Accordingly it is not intended that the cluster funding rates would match the cost structure of any higher education provider"*

This requires teaching capacity to cover the various sub-disciplines to produce well rounded graduates at honours level and the smaller number of graduates with specialist training eg geophysics, hydrogeology. The AGC believes that a minimum number of geoscience teaching centres (~10) with a critical mass of teaching expertise is required to deliver the number of graduates that the nation requires and that these departments need to be strategically located around the nation to ensure that all catchment areas for potential students are adequately covered. In addition further geoscience teaching capability is required to ensure adequate educational opportunities in the strategically important disciplines of earth sciences are available nationally given that earth sciences has little or no profile or role in the secondary education system in Australia. The AGC is planning a summit of interested parties in 2007 to canvas national needs for geoscience education from the perspective of its member professional and learned societies and major employers.

Recommendation 1: The Commonwealth Government undertake a national strategic approach to the identification of Tertiary education needs in minority disciplines such as geoscience and ensure in the negotiation of funding with universities that these needs are being met nationally.

The AGC would be prepared to provide relevant expertise from its member societies to assist any such national approach.

Recommendation 2: In funding of institutions in minority discipline areas such as geoscience, the Commonwealth Government have regard to the need for a minimum number of teaching centres with sufficient critical mass of expertise to cover the various sub-disciplines and ensure the production of appropriately qualified graduates.

Response to Discussion Questions
Funding Cluster Mechanisms
The Australian Geoscience Council is able to provide specific comment on the first two discussion questions as follows:

1. *Do the current funding clusters adequately reflect broad discipline relativities?*
2. *Are individual disciplines placed disciplines placed in appropriate clusters? Are there any undesirable consequences of the placement of specific disciplines in particular cluster?*

   The evidence from the geosciences strongly indicates that the present cluster funding mechanism discriminates against disciplines where there are inherently lower student numbers and lower demand for graduates. The geosciences are more like the agricultural sciences, being expensive to teach, have significant application to the long-term development of rural and regional Australia and have inherently lower student numbers. Under the present arrangements the geosciences are more appropriately placed in the higher funded Cluster 10 - Agriculture Cluster rather than Cluster 8.

The AGC does not have any specific comments concerning discussion question 3 and 4.

Recommendation 3: Geosciences be placed in cluster 10 to form an Agriculture and Geosciences Cluster

Pipeline Funding Arrangements

The Australian Geoscience Council's comments on the discussion questions are as follows.

5. *Should the current standard pipelines for most new Commonwealth supported places across most disciplines be kept? Does it unduly constrain providers in the provision of new places?*
6. *If the current model sere to be largely retained, should any further exceptions be made?*

The present arrangements fund places at a constant amount per annum for an individual discipline cluster throughout a course. In the light of the experience in geosciences, this discriminates against low volume courses with high resourcing complexity in terms of teaching specialities, laboratories and fieldwork requirements. The AGC believes this is undesirable from a national perspective and as a result there is a lack of transparency in how Commonwealth funding affects national outcomes. The AGC believes that within each cluster the pipeline arrangements should reflect the progressively increasing cost of units of study in successive years of study towards a major /honours degree. In combination with the national strategic approach outlined above, the AGC believes outcomes will be more predictable and more in line with national needs for graduates in minority disciplines such as geoscience.

Recommendation 4: The cluster/pipeline funding arrangements be changed to recognise the progressive increase in costs of teaching and teaching resources as students move through a course of study towards a major/honours degree.

APPENDIX: Steps taken by the geoscience community and related employers and organisations to address the plight of tertiary geoscience education

Stimulation of Interest in Geoscience Education

There is a strong grass roots interest in AGC member societies in stimulating interest in geoscience at the level of schools and universities and a number of initiatives have been undertaken or commenced. These are complemented by the work of industry bodies. Examples include:

Australian Geoscience Council (AGC)

The AGC is launching a geoscience education newsletter for circulation to organizations and individuals. The newsletter is designed to:

- Provide a vehicle for the reporting and discussion of geoscience education news, issues and activities.
- Facilitate communication between individuals and groups involved in geoscience education.
- Promote collaboration on geoscience education issues.

Australian Institute of Geoscientists (AIG)

The AIG is involved in a variety of geoscience education activities, at both state and national levels. The activities include:

- Involvement in school geoscience activities and presentations.
- Financial and logistical support for university student field trips.
- Free student membership of the AIG to encourage students to interact with professional geoscientists.
- Financial support for travel and accommodation for students giving presentations at conferences.

Australian Petroleum Production and Exploration Association

- APPEA has developed a number of educational programs for use in primary and secondary schools. These include the 'Speaking of Oil and Gas' sessions whicjh ae currently avialable to schools in WA and are delivered by presenters from the World of Energy Freemantle.
- The Petroleum Club of WA in conjunction with APPEA has has run the highly successful Schools Information Program for year ten school students since 1991.

Australasian Institute of Mining and Metallurgy (AusIMM)

The AusIMM runs several geoscience education activities at schools and universities, including:

- The Australian Student Mineral Ventures – 10 day residential vacation programs for Year 10, 11 and 12 students. The programs are held annually throughout Australia, and involve tours of mines sites and laboratories, hands-on activities, and interaction with graduates and industry professionals.
- Provision of information on geoscience careers, including website material, flyers, and a booklet titled "Professional Careers in the Minerals Industry. The material is distributed widely, including via AusIMM members and local branches, at careers fairs and schools, and through the Australian Government's Careers Advice.

Geological Society of Australia (GSA)
The GSA funds an Education and Outreach Officer. The role of the Education Officer is to promote and facilitate geoscience education in Australian schools. Recent activities of the Education Officer include:

- Reviewing geoscience curricula in secondary schools across Australia, and identifying gaps in teaching resources.
- Organising a booth and several speakers on geoscientific topics for the Conference of the Australian Science Teachers Organisation in Perth in July.

Petroleum Exploration Society of Australia (PESA)
PESA is very active in the area of geoscience education, and the activities of the society include:

- Generation of teaching resources for secondary schools, including: posters, flyers, oil sample kits, rock sample kits, interactive CDs, and interactive quizzes for students.
- WA Schools Information Program, comprising a six lecture series and linked student projects; the program has been so successful it has recently been extended to the Northern Territory.
- Minerals Education Victoria – a program of talks on minerals, gold, oil and gas for primary and secondary schools.
- Student Feedback Workshop, Victoria and Tasmania, profiling teaching resources and presentation material to geoscientists and year 9 students.
- Planned development of a national Teacher Earth Science Education Programme for secondary school teachers, and involving workshops, field trips, and site visits, and a national extension of the ESWA initiative (see below).

Earth Science Western Australia (ESWA)
ESWA is a consortium of organizations, including representation from AGC member societies, that was formed in 2003 to raise the profile of geoscience in WA secondary schools to a level matching the strategic needs of the state. ESWA is strengthening earth science education by:

- Developing an extensive range of learning resources to ensure relevant, Western Australian, contextualized learning for students.
- Coordinating seminars for teachers to enhance their geoscience knowledge and skills.
- Linking teachers with professional geoscientist mentors.
- Enhancing student learning through assisting with school field trips.

ESWA is currently providing major support for the new WA year 11 and 12 Earth and Environmental Science (EES) curriculum. Since the initiation of ESWA there has been a significant rise in the number of students studying Earth Science in Western Australia, from 44 students taking TEE Geology in 2006, to over 225 students studying EES in 2007. ESWA has also recently received further support to enable the extension of the EES initiative to include years 8 to 10.

Support for Training of Geoscientists
A related issue is the supply of appropriately qualified graduates and information on the availability of employment opportunities for appropriately qualified geoscience graduates. Again a number of initiatives have been taken by geoscience and allied industry institutions.

The Minerals Tertiary Education Council has funded teaching positions at number of universities to ensure appropriate minerals courses are taught that will meet the requirements of the minerals industry MTEC is a collaborative program between the minerals industry, the academic community and government, aimed at increasing the supply and quality of technical professionals for the minerals industry in the specialist disciplines of geoscience, mining engineering and metallurgy. A major initiative in 2004 for secondary students was the development of two online interactive learning programs – the *Down to Earth* geoscience series of six inter-related geoscience components, and the interactive chemistry challenges named *Oresome Froth*. These two packages are designed to stimulate and engage students, providing them with science-based learning experiences that utilise the Australian minerals industry as the context for self directed learning.

The AusIMM has embarked upon a comprehensive program of attraction initiatives on campus, centred around a set of new careers brochures and booklets, and have developed a set of best practice Graduate Program Guidelines in response to feedback between what the graduates expected and what the companies provided..

Geoscience Australia has instituted cadetships for undergraduates of appropriate academic standard taking particular courses of study at the Australian National University.

In other instances scholarships have been provided:

Australian Institute of Geoscientists (AIG)

- Annual bursary awards to geoscience Honours and Postgraduate students. Bursaries have been awarded to 36 students at 15 Australian universities since the inception of the Bursary Program in 2001.
- The Cundy Medal award to an aspiring geoscientist in Victoria.
- The annual AIG WA medal award to an outstanding geoscience student at Curtin University.

Australian Society of Exploration Geophysicists (ASEG)

The ASEG Research Foundation was founded in 1989 with the objective of attracting high-calibre students into exploration geophysics. The ASEG RF achieves its aim by promoting research in applied geophysics specifically by providing research grants at the B.Sc.(Hons.) and M.Sc level or equivalent, and to Ph.D. projects. The grants are paid directly to the relevant Australian University departments to cover field or laboratory expenses associated with the project.

Australian Petroleum Production and Exploration Association

APPEA provides a scholarship for Honours study and a scholarship for professional development in topics related to the oil and gas industry,

Geological Society of Australia (GSA)

- The annual Frank Canavan Award to a student completing second year geology at a Victorian University.
- The De Thomas medal for the best geological map produced by a geoscience Honours student in Victoria.

- The Talbot Medal awarded to the student completing the best Honours thesis with a significant field work component at the University of Western Australia.
- The GSA Medal (WA) to an outstanding student completing a BSc (Geology) degree at Curtin University of Technology.
- The TEE Prize awarded to the student achieving the highest mark in the Geology Tertiary Entrance Examination.

Australasian Quaternary Association (AQUA)

- The J.M. Bowler Prize award to the best PhD and Honours student papers presented at the Association's biennial conference.
- The Postgraduate Travel Prize to support postgraduate students in the field of Quaternary studies in attending an international conference to present the results of their research.
- Student Travel Support for students giving a presentation at the AQUA biennial conference.

Australasian Institute of Mining and Metallurgy (AusIMM)

The AusIMM Education Endowment Fund offers scholarships to students in geoscience programs at 10 universities. Twenty scholarships, each valued at $7000 over two years, will be offered in 2007.

Petroleum Exploration Society of Australia (PESA)

PESA provides scholarships Post-Graduate Scholarships For Research In Geosciences at an Australian Tertiary Education Institution, undertaking a research project with relevance to Petroleum Geology or Geophysics, e.g. sedimentology, basin analysis, geophysical modeling, seismic interpretation, paleontology, petroleum geology, etc.